



# The gains in life expectancy by ambient PM<sub>2.5</sub> pollution reductions in localities in Nigeria<sup>☆</sup>

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## ABSTRACT

Global burden of disease estimates reveal that people in Nigeria are living shorter lifespan than the regional or global average life expectancy. Ambient air pollution is a top risk factor responsible for the reduced longevity. But, the magnitude of the loss or the gains in longevity accruing from the pollution reductions, which are capable of driving mitigation interventions in Nigeria, remain unknown. Thus, we estimate the loss, and the gains in longevity resulting from ambient PM<sub>2.5</sub> pollution reductions at the local sub-national level using life table approach. Surface average PM<sub>2.5</sub> concentration datasets covering Nigeria with spatial resolution of ~1 km were obtained from the global gridded concentration fields, and combined with ~1 km gridded population of the world (GPWv4), and global administrative unit layers (GAUL) for territorial boundaries classification. We estimate the loss or gains in longevity using population-weighted average pollution level and baseline mortality data for cardiopulmonary disease and lung cancer in adults ≥25 years and for respiratory infection in children under 5. As at 2015, there are six “highly polluted”, thirty “polluted” and one “moderately polluted” States in Nigeria. People residing in these States lose ~3.8–4.0, 3.0–3.6 and 2.7 years of life expectancy, respectively, due to the pollution exposure. But, assuming interventions achieve global air quality guideline of 10 μg/m<sup>3</sup>, longevity would increase by 2.6–2.9, 1.9–2.5 and 1.6 years for people in the State-categories, respectively. The longevity gains are indeed high, but to achieve them, mitigation interventions should target emission sources having the highest population exposures.

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## 1. Introduction

Globally, remarkable gains in life expectancy have been achieved, with global average lifespan rising from 66.4 years in 2000 to 71.4 years in 2015 (WHO, 2016a). Although the gains were highest

in Africa during that period – an increase from 50.6 to 60 years – the region still has the lowest life expectancy in the world (WHO, 2016a). The situation is much worse in Nigeria where people have an even shorter lifespan of 54.5 years (WHO, 2016a).

One of the top risk factors responsible for the short lifespan in Nigeria is air pollution. The toll of premature deaths attributed to air pollution in Nigeria is the largest in Africa, and among the top 5 position in the world (IHME, 2016; OECD, 2016a; WHO, 2016b). It is estimated that exposure to air pollution (ambient and household combined) currently accounts for ~114 thousand annual deaths and ~5.4 million disability adjusted-life years (DALYs) lost in Nigeria (IHME, 2016), with the attendant economic cost of ~USD 112 billion, annually (OECD, 2016a). The death toll attributed to air pollution exposure in Nigeria exceeds that due to childhood underweight,

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